Consumer valuation of safety-labeled free-range chicken: results of a field experiment in Hanoi

Jennifer Ifft[a,*], David Roland-Holst[b], David Zilberman[b]

[a]*U.S. Department of Agriculture, Economic Research Service, 1400 Independence Avenue, SW, Mail Stop 1800, Washington, DC 20250-1800, USA*
[b]*University of California-Berkeley, 207 Giannini Hall 3310, Berkeley, CA 94720, USA*

Abstract

This article presents results of a field experiment designed to assess willingness to pay for safely produced free-range chicken in Hanoi, the capital of Vietnam. Improved safety of chicken production and trading is suggested as an important component of avian influenza control strategy, which aims to address the direct costs of avian influenza as well as the global public health externality. However, consumer demand for safely produced free-range chicken is unknown. Products that have credible food labeling are not common in traditional markets where the majority of free-range chicken is purchased. Valuing characteristics of products sold in informal markets is a major challenge that our experiment overcomes. As part of the experiment, we provided several vendors from these markets with safety-labeled free-range chicken. Consumer valuation of safety labeling was elicited through having experiment participants, who were representative of potential consumers, select between discount coupons for either safety-labeled chicken or regular chicken. Results indicate that consumers will pay at least $0.50, or a 10–15% premium, per chicken purchase for safety labeling, which emphasizes safe production, processing, and transport conditions. This premium is smaller than the premium currently paid for traditional chicken varieties that are considered to be tastier. Consumers with more education have higher valuation of safety labeling. Hence, safety labeling for high-quality free-range chicken can play a role in controlling livestock disease and improving public health.

JEL classifications: C93, D12, Q01, Q18

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Highly pathogenic avian influenza (HPAI) became endemic to Vietnam after several large outbreaks from 2003 to 2005 (Rushton et al., 2005). In addition to a total of 59 human deaths of 117 cases as of March, 2010 (World Health Organization, 2010), HPAI has caused an estimated U.S.$200 million of losses to Vietnam's economy. A total of 59.3 million head of poultry have either been killed by HPAI or culled (Burgos et al., 2008). The direct economic cost and magnitude of potential public health externalities of HPAI made it a priority for policymakers and global decision makers. HPAI is a livestock disease that most directly affects producers and food markets but has global implications. That is, a major influenza pandemic could arise from the evolution of the H5N1 virus that causes HPAI. While this is a low-probability event (Peiris et al., 2007), the current estimated global economic loss from HPAI is $20 billion and the

costs of an influenza pandemic triggered by HPAI are estimated to be $2 trillion (FAO et al., 2008).

Policies to control HPAI in developing countries, such as Vietnam, face several challenges. Although some poultry production is concentrated geographically or with large producers, the majority of poultry production is on a small-scale, free-range, and by diversified rural farmers. The production characteristics of free-range chicken are different from those of confined (translated from Vietnamese as "industrial") chicken, with both presenting unique food safety and animal disease risks. Free-range chicken is more likely to be exposed to wild birds whereas industrial chicken production present risks inherent to concentrated production (Otte et al., 2008). These types of chicken are also produced on different types of farms and marketed through different supply chains (Ifft et al., 2008) necessitating differentiated policies.

Policies to control the spread of HPAI have largely focused on industrial production, and have even mentioned plans to phase out small-scale or free-range production. This has led to

*Corresponding author. Tel.: 202-694-5552; fax: 202-245-4847.
E-mail address: jifft@ers.usda.gov (J. Ifft)

free-range chicken being less likely to be incorporated into formal supply chains and regulatory mechanisms. Furthermore, free-range chicken commands a large quality premium and makes up the majority of at-home chicken consumption in urban areas. One way to decrease disease and safety risks associated with free-range chicken production is market development for safe free-range chicken. Although "safety" has multiple components, in this study, we are focusing on safe production, processing, and handling practices that can both improve food safety and decrease risk of HPAI and other poultry diseases. Specifically, we consider vaccination for major poultry diseases as well as hygienic production, processing, and handling guidelines that are mandated by national regulations. For brevity, this will be referred to as chicken that is "safe" or "safely produced." Chicken that is sold with claims of such practices will be referred to as chicken that is "safety-labeled."

In Vietnam, the magnitude to which consumers value safely labeled free-range chicken is unknown yet critical for policymakers because markets for safely produced free-range chicken could lead to an improvement in production and trading practices that impact risk for HPAI as well as other diseases. Results of a field experiment that we conducted in Hanoi are used to consider three key questions related to safety labeling of free-range chicken in Vietnam: (1) What is the willingness to pay (WTP) for chicken with a safety label? (2) What is the WTP for safety relative to taste characteristics? and (3) Which groups are willing to pay more for safety labeling?

Awareness of how different breeds of chicken are raised is high among urban households in Vietnam, with consumers correctly linking breed and production environment to desired meat quality characteristics (Ifft et al., 2007). Ifft et al. (2009) used cross-sectional household data to determine that free-range chicken has a positive income elasticity in Hanoi. For chicken purchased for home consumption, about 75–80% is free-range chicken. Free-range chicken is considered to be very tasty and commands a premium of up to 100%. Consistent with results by Heiman and Lowengart (2011), taste appears to be the key consideration for chicken purchases in Hanoi. This is similar to chicken consumption in France where, despite a large premium, 50% of all chicken purchases are for Label Rouge chicken, which emphasizes sustainability, food safety, and quality (Westgren, 1999).

Existing data in Vietnam were not suitable for this study, which is a typical challenge for researchers measuring demand for safely produced food in developing countries related to the informality of food markets. Data on purchases and prices of food products in markets are rarely collected and standard household surveys (such as the Living Standards Measurement Study) use broad categories of food types, such as beef or poultry. Market data on chicken consumption in Vietnam would have allowed for demand analysis with treatment of HPAI outbreaks as a natural experiment but were not available. Most urban Vietnamese households prefer to consume fresh food that is purchased daily in traditional markets near their homes (Maruyama and Trung, 2007), where records of sales are gen-

erally not kept.[1] Free-range chicken varieties are largely sold in these traditional markets without safety claims.

The majority of studies on the valuation of food characteristics and safety (e.g., Lusk et al., 2005; Yiridoe et al., 2007) have been undertaken in industrialized countries and use either retail scanner or experimental data. Only a few studies have considered consumer demand for chicken characteristics. Beach and Zhen (2008) found that in Italy media coverage of HPAI outbreaks led to decreased chicken consumption for several months. Studies in China (Jin and Mu, 2012), Canada (Innes and Cranfield, 2009), and Denmark (Morkbak and Nordstrom, 2009) have used contingent valuation to measure demand for various chicken characteristics. These studies used stated-preference methods, which can lead to inflated values (List and Gallet, 2001). Our study uses experimental methods and involved real trade-offs between discount coupons. Experimental methods have largely not been adapted to the unique challenges in developing country settings to value meat characteristics and food safety.

Field experiments are preferable to other potential methods to measure demand for safety-labeled chicken (SLC) in Vietnam given that household survey and other data are not sufficient. Harrison and List (2004) define several important areas that distinguish a field experiment, including use of the subject pool and commodity or interest. Of the three broad types of field experiments they define, this study is the closest to a "framed field experiment," because it uses both randomly selected Hanoi households that are representative of potential consumers and actual safety-labeled free-range chicken with participants being aware of the research taking place.

Several laboratory and field experiment methods have been used to value food safety and quality characteristics in developed country settings, generally either through choice experiments or demand revealing auctions, both of which ideally involve "real money" and the actual product of interest. Choice experiments can be conducted in the marketplace or a laboratory setting, and are designed to reflect choice situations similar to those encountered naturally in the marketplace. The key element of these experiments is that participants make trade-offs between goods with different characteristics, and those trade-offs have real repercussions for participants. In most cases, participants must select among certification or safety-related characteristics or among quality-related characteristics. It is quite rare for field experiments to allow for direct trade-offs between safety and quality (or taste). Chowdhury et al. (2011) measure trade-offs between traditional sweet potatoes and newer, more nutritious varieties in Uganda. Our study builds on this by measuring the trade-off between taste (for a traditional variety) and safety.

The approach developed in this article was sensitive to the structure of poultry markets in Vietnam. Many studies on WTP

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[1] Informal markets include "wet" or open air markets where fresh produce, meat, and poultry is sold, which characterizes the meaning of "cho"—the Vietnamese word for market. Each neighborhood or ward in urban areas of Vietnam is likely to have its own cho.

for food safety are conducted in a laboratory setting; however, in Vietnam the location of chicken purchase (usually a traditional market), is very important to consumers. Our experiment inserted a new product in a traditional market, and used experiments to assess WTP for this new product.

This field experiment involved the design and implementation of a certification scheme for safely produced chicken and used discount coupons to elicit the value for safety labeling as well as taste characteristics. Other studies that designed a product, such as infant formula in Masters and Sanogo (2002), typically involve manufactured consumer products. A major challenge for our study was to convince poultry farmers to modify their production system and to adhere to practices that were prescribed by external certification and safety-labeling guidelines. Although some studies have used coupons or vouchers to elicit preferences for certain product characteristics, our study provided consumers with a choice between coupons, which enabled direct estimation of trade-offs among safety and taste characteristics. Generally, field experiments have not been able to allow for direct trade-offs between safety and taste. While coupon-based approaches and experiments to value food characteristics, in general, have been used in formal markets, this article expands the range of circumstances where coupons can be used in field experiments and demonstrates that this approach can be used with merchants who are operating in open air markets. An approach to field experiments that can be used in informal market environments is useful for addressing policy and development issues in food markets and the agricultural sector in developing countries.

We find that WTP for safety-labeled free-range chicken in Hanoi is significant (approximately, a 10–15% price premium) and that consumers may trade safety for taste characteristics embodied in variety. We further find evidence that more educated consumers have a higher inclination to purchase SLC, but that their previous choice of chicken breed did not affect selection of SLC. The results indicate that safety labeling could be effective for different varieties of free-range chicken, reaching a broader market and playing a role in policies related to livestock disease and public health. Furthermore, the magnitude of the potential impact of safety labeling is large. The cost of safety labeling is small relative to the potential benefits, and the demand for safety labeling appears not to be related to demand for traditional breeds.

1. Field experiment design

To measure consumer valuation of safety-labeled free-range chicken, a choice experiment was adapted to the circumstances in Hanoi poultry markets. Several poultry and chicken vendors agreed to sell SLC for a short period and also to respect coupons for both SLC and unlabeled chickens. Experiment participants were recruited through a household survey as shopping is undertaken in a very narrow window of time where most shoppers would not have time for an experiment. Household survey re-

spondents were given a choice between two coupons with randomly determined discounts—one for SLC and the other for regular chicken.

An FAO-implemented pilot project for a certified supply chain for smallholder chicken in Hanoi was utilized for its supply of the commodity of interest.[2] The SLC were sourced from small farms in a large rural district of Hanoi municipality. Two major types of free-range chickens are raised in Vietnam, which are directly translated as "local" and "crossbred." Local chicken refers to native breeds raised on a scavenging diet whereas crossbred chicken are native and exotic crosses allowed to scavenge in a garden or confined grazing area with occasional purchased feed. All project chickens were crossbred chickens, as sourcing local chicken would have been too expensive given dispersion and small numbers produced at each farm. Crossbred chicken is a substitute for local chicken, as it has been estimated to have positive and statistically significant cross price elasticity with local chicken, but smaller and statistically insignificant cross price elasticity with industrial chicken (Ifft et al., 2007). Furthermore, according to survey data from the FAO project, uses or preparation styles for crossbred chicken are more similar to local than industrial. Sixty percent of all local chicken is prepared as boiled, compared to 31% of crossbred chicken and only 7% of industrial chicken. Likewise, 39% of all industrial chicken is prepared by frying, compared to 12% of crossbred chicken and 6% of local chicken.

Each project farm was required to have vaccination for HPAI and other common poultry diseases and follow national safety and environmental regulations for poultry production. These farms were closely monitored by local veterinary officials, which were under the supervision of the district veterinary office. Farms were also randomly visited by an external veterinary inspector as an additional safeguard. Within a week of slaughter, a small but distinguishable tag was put on the foot of each chicken by local veterinary officials. The tag was designed to survive the slaughtering process but, if removed, it could not be reused.

Through coordination with traders, the project chicken was delivered to registered slaughterhouses at a small wholesale market.[3] The slaughterhouses then sold the chicken through their distribution network to eight vendors in four markets. The vendors were supported with training and advertising materials. These included posters and brochures describing the production conditions of the chicken and how the chicken could be traced to the farm of origin. The SLC was only visually distinguishable from other chicken by the tag. Vendors were responsible for recording information on all chicken sales before, during, and after the testing-marketing period, although some struggled with this unfamiliar activity.

An economic experiment was undertaken while the SLC was being introduced. The decision to conduct recruitment through

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[2] Free-range chicken is largely produced by small-scale producers, who generally do not have sufficient resources to produce industrial chicken.

[3] Very few slaughterhouses in northern Vietnam achieve registration, or government certification.

sampling for a household survey instead of in the market was based on shopping habits. Women conduct most of the food shopping in Hanoi and usually make daily trips to markets to purchase fresh food. Markets tend to be very crowded and busy for a short period of time after working hours when shoppers are in a rush to prepare a meal for their family. During this period, recruitment of survey respondents would have been difficult, and recruiting respondents at another time would have led to a less representative sample and introduced sample selection bias. Enumerators, however, could visit households at times which were convenient for the respondents.

Hanoi has several neighborhoods, all with at least one local market. Hence, each market has a "catchment area" that does not necessarily follow administrative boundaries. The catchment area for each market was defined through consultations with the market vendors. Within this area, blocks were randomly selected and all households in those blocks were listed. Systematic random sampling was used to select households within each market area, for a sample of households that would be representative of all households that might regularly visit each market where SLC was being sold. Of 1,200 selected households, 923 households took the household survey. All selected households were visited by enumerators to conduct a detailed survey about food consumption and attitudes that took 20–25 minutes. Enumerators interviewed the person with primary responsibility for food purchases for the household.

Very few field experiments have been conducted under situations with a such a high level of informality. Conducting the field experiment after the household survey allowed us to avoid situations with negotiations for small deviations from average prices between buyers and sellers, which are ubiquitous in Vietnamese markets. We offered individuals a choice between coupons before going to the market to consider their choices independent of price negotiation. Loureiro et al. (2002) used a stated preference exercise to determine valuation of ecolabel apples, which was followed by an economic experiment that involved giving customers three discount coupons for three types of apples (Loureiro et al., 2003). Although coupons were given for three types of apples, almost all recipients that did redeem a coupon used the coupon for one type of apple that was emphasized in the study. The use of coupons was adapted in this experiment to have participants select between coupons before redemption. This provided control over the participant's choice set and allowed for analysis of the trade-offs between chicken characteristics for each coupon.

The experiment follows the diagram in Fig. 1, which shows the structure of each choice, with the amount of discount and breed of "regular" (no safety label) chicken being randomized. After the survey, each respondent was offered a choice between two discount vouchers for two types of chicken as a gift for taking the survey. Each set of two discounts was randomly assigned to each household, with one alternative being SLC (crossbred) and the other alternative being either regular crossbred or local chicken. The discounts varied from about $0.90 to $1.60 in increments of about $0.16. Whether the regular alternative
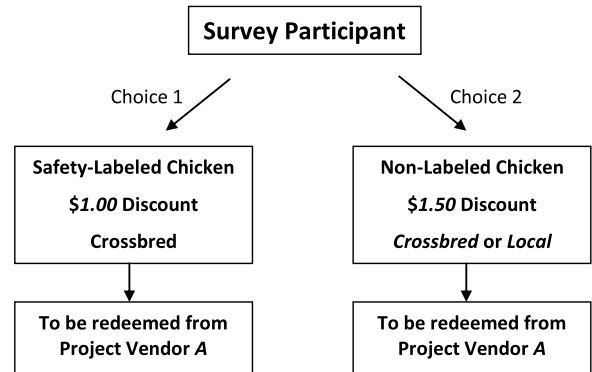
Note: Characteristics in italics were randomized; 887 households participated in the experiment.

Fig. 1. Experimental design.

was local or crossbred was randomly assigned independent of discount, with both alternatives to be purchased from the same vendor. The respondent was told the market price of each type of chicken and was given a brochure explaining SLC before they made their choice.[4] This would be similar to the market, where the same brochure was available for the SLC, but regular chicken had no advertising or marketing. Both types of chicken had the same appearance, and enumerators were trained to give no additional information.

The framing of field experiments has been empirically shown to motivate behavior considered to be "pro-social" (Lusk et al., 2006), so this experiment was designed to minimize framing and experimenter demand effects. Because advertising materials for SLC emphasized benefits to individual consumers and the survey contained no new direct or implied information of what would have been "correct" behavior, any pro-social behavior would have been based on existing perceptions of individual participants. Participants were making a choice under similar information and alternatives than what was available in the market at same time. No additional information was provided other than that which was already available in the market, and enumerators did not personally have to provide an explanation of the safety label. Because direct persuasion by a seller is a key aspect of transactions in Vietnam and enumerators were identified as employees of a research project instead of a company, participants would have been under considerably less pressure than they face every day when purchasing food. The survey focused on several aspects of food consumption and household demographics, and not exclusively on food safety and poultry issues. In some cases, respondents remarked during follow-up that they did not initially realize the purpose of the study given the wide variety of questions.

After selection of a discount coupon, the participant was given a coupon with their name, the discount, and the type of

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[4] The brochure contained information on how safe production practices were used and verified, the traceability mechanisms, and other general information on production and processing practices that were used.

chicken. This coupon had to be used within one week. The choice between two types of whole chicken is not uncommon: local and crossbred chicken together made up about 87% of purchases for survey respondents, and most chicken is purchased whole. The household survey format had the advantage of having detailed background information on chicken consumption for a representative sample, as well as allowed for testing of the impact of household characteristics on demand for SLC.

Participants might have been offered the choice of a third option, such as cash. Due to security issues, enumerators did not carry cash with them while implementing the survey. Given that we faced this constraint, we developed an approach that elicited the relative importance of safety to consumers. Having an outside option, such as cash, is standard and desirable in choice experiments, and having no outside option raises potential concerns that participants might select an alternative that they might not have otherwise wanted. For this study, this is less of a concern because almost all households in Hanoi regularly consume chicken. Other than safety, coupons differed by taste and money, which were desirable characteristics for participants. If a consumer did not choose safety, she could select a coupon for type of chicken that was regularly purchased.

Having participants make a series of choices is common in experiments (e.g., Masters and Sanogo, 2002). We could have given each participant a choice between two discount vouchers (or coupons) and repeated the exercise several times with one choice randomly selected as binding. Explaining this procedure and conducting the series of choices would have added additional time to the survey and experiment, likely increasing complexity and decreasing reliability. Although we have one choice set per participant, our sample size is large. Having one choice can also be considered realistic as Vietnamese households tend to shop every day and buy only enough food for one or two meals.

The decision of presenting the coupon as a discount from total chicken purchase or a low(er) price for a chicken purchase was based on the requirements of the FAO certified supply chain project. As a part of their contracts, vendors had to record all prices for all chicken sold, including project chicken. Recording of individual prices and sales was unfamiliar for most vendors, so having a discount coupon that was easy to use and redeem was very important. Vendors could not be given any incentives to misreport prices, as would be the case with a discounted total price. Hence, a discount coupon was used.

As evidenced by Mergenthaler et al.'s finding of a 60% price premium for Chinese mustard free of chemical residues (2009), Hanoi consumers are very concerned about food safety. However, the novelty of the safety label might have motivated participants and might not reflect behavior under repeated purchases. Any single-period market test or field experiment is subject to curiosity for a new product, but we also cannot quantify the impact of curiosity versus skepticism. Market vendors from the project reported frequent suspicion of new products by consumers. Although many were curious about SLC, others were suspicious. We cannot identify these effects but, instead, must interpret our results as indicating the current valuation for and interest in safely produced chicken, not necessarily valuation over the long term, which could only be known after markets for SLC operated for some time.

2. Empirical model

Our empirical model is specified for the choice of a coupon, not for the choice to redeem the coupon. Given the unobservability of the choice set at the time of redemption, valuation of SLC cannot be determined from the choice to redeem or not redeem. By selecting a coupon, experiment participants are selecting their preferred option for buying a chicken at a discounted price. This potential purchase would be constrained by their household food budget and is the basis for our empirical model.

Utility from food consumption is commonly represented as utility from a set of food characteristics. The household production function of Becker (1965) is frequently applied to estimate food and nutrition choices. Silberberg (1985) showed that "pure nutrition" takes a smaller portion of the budget as income increases. Hence, several food characteristics will be relevant when estimating food demand for households with disposable income. Lancaster (1966) argues that utility is derived from characteristics of goods, such as taste and nutrition, as opposed to goods alone. Random utility theory as developed by McFadden (1974) is well suited to Lancaster's characteristics approach. Random utility models are commonly used in discrete choice analysis (Hanemann, 1984), with utility as a function of a set of observed characteristics and a stochastic component that represents unobserved factors that enter the utility function. Using this framework, utility from a good i for individual j can be defined as $U_{ij} = f(x_j, z_{ij})$, where z_{ij} is a set of characteristics of good i and x_j is all other consumption.

The choice that each individual made between types of chicken can be modeled in the context of its impact on utility, where utility is a function of consumption of chicken characteristics and consumption of all other goods. We treat the price of all other goods as unity and denote expenditure (or income) as Y_j. Each individual has a discrete choice between two types of chicken—c_1 and c_2. Each chicken choice i for consumer j has a price of p_{ij}, a discount of d_{ij}, and a vector of characteristics $z(c_{ij})$. Unobserved variation in the factors affecting an individual's utility is denoted as ε_{ij}, and is assumed to follow an extreme value distribution with zero mean. When presented with a choice between consuming two types of chicken, each individual then faces the following utility maximization problem (if we assume utility to be linear and separable in chicken characteristics and other expenditure)

$$\max_{c_i} U_{ij} = \boldsymbol{\beta} z(c_{ij}) + \boldsymbol{\delta} \left(Y_j - (p_{ij} + d_{ij}) \right) + \varepsilon_{ij}, \qquad (1)$$

where $\boldsymbol{\beta}$ and $\boldsymbol{\delta}$ are vectors of coefficients that represent the relative share of each characteristic in utility. Other than the chicken

characteristics defined in our experiment, which were discount, price, SLC (s_i), and breed (v_i), no other differences in characteristics could be discerned by the participant. By conducting a field experiment, the characteristics of goods that are offered to consumers are controlled or randomized. Because discount, safety, price, and variety were randomly assigned, we assume that the error term or unobserved variation in utility is not correlated with our observed characteristics, or $\mathbb{E}(\varepsilon_{ij}z_i) = 0$ for observed characteristics.

From this framework, we can use a logit model to estimate the price and characteristics coefficients and valuation for safety labeling and variety (Train, 2003). Many of the disadvantages of a logit are related to independence of irrelevant alternatives and panel data with correlation in factors not observed by the researcher. Given that this experiment had only two alternatives and one choice situation, these issues do not arise. Use of a mixed logit would allow for estimation of taste variation across individuals, but initial analysis of our data indicated that the number of alternatives or individual choice situations was too low for effective mixed logit estimation. Logit analysis, hence, is an acceptable approximation for average tastes (Train, 2003).

To implement a logit, we consider differences in utility between alternative choices. If a participant j has two choices, she will choose option i over option k if option i provides higher utility. The difference in errors between these options has a logistic distribution, which is a well-established property of these models. We then know that the probability of picking alternative i for individual j is $P_{ij} = \frac{\exp(\beta z_{ij})}{(\exp(\beta z_{ij}) + \exp(\beta z_{kj}))}$, where we have simplified $\boldsymbol{\beta}$ as a vector of all coefficients, and z as a vector of all characteristics. The observed portion of the utility function that corresponds to our estimating equation is $V_{ij} = \beta_1 s_{ij} + \beta_2 v_{ij} + \delta_1 d_{ij} - \delta_2 p_{ij}$. Income is not included in our primary estimating equation because our model only considers the difference in utility between chicken options.

From logit estimation, we can easily estimate WTP, or compensating variation, for specific characteristics. We use the interpretation of WTP over willingness to accept (WTA) because individuals were constrained by a household food budget. From our random utility model, WTP for SLC can be defined as C s.t. $U(s = 0, d) = U(s = 1, d - C)$, which gives $C = \frac{\beta_1}{\delta_1}$ for chicken of the same variety and price. This follows the general interpretation of welfare from the parameters of logit models (Train, 2003). We use WTP as the most realistic interpretation of potential gains given the choices made, but recognize that the functional form we use for estimating utility has no income effects and, hence, admits the same welfare measurement for equivalent variation (WTA) and even consumer surplus (Hanemann, 1984).

2.1. Extensions and robustness

Several studies have shown that demographic and socioeconomic factors as well as other food characteristics can impact demand for food safety (e.g., Heiman et al., 2000). The impact of these factors on demand can improve understanding of underlying preferences and inform policy. Various household characteristics (X) can be added our to utility function by interacting s with X for the following specification: $V_{ij} = \beta_1 s_{ij} + \beta_2 v_{ij} + \boldsymbol{\beta_3}(s_{ij} \cdot \boldsymbol{X}_j) + \delta_1 d_{ij} - \delta_2 p_{ij}$.

Demographic factors and attitudes with positive values for β_3 would increase utility from SLC. Previous behavior is also of interest as habits have been shown to influence food demand (Blanciforti and Green, 1983), so we include previous chicken consumption choices in our analysis. Individual household characteristics will be tested with our basic empirical specification, as well as a more general specification that includes several characteristics that impact choices. WTP for safety is $\frac{\beta_1 + \boldsymbol{\beta_3} X_j}{\delta_m}$, where δ_m is the contribution of money (price or discount) to utility.

The way in which price and discount enter the utility function will affect our analysis. The marketing literature provides several examples of how consumers react differently to discounted prices, actual prices, and actual discounts. Guadagni and Little (1983) find that both discounted price and advertised percent discount impact product choice, but the impact of a promotional price cut is higher than the actual promotional price. Previous consumer experiments have shown that coupons for brands are valued more and that, more generally, framing of discounts or promotions can have an impact on coupon valuation (Krishna et al., 2002). The concern that discounts for safety-labeled or local chicken have a greater value can be tested by interacting SLC and local chicken with discount and estimating these interaction terms with our logit model. These interaction terms allow for testing that, for chicken with characteristic j, discount enters utility as $\delta_1 d_{ij} + \gamma d_{ij}$ while, for chicken with characteristic k, discount enters utility as $\delta_1 d_{ik}$. If the interaction variables have a statistically significant impact on choice or improve the fit of the model, then the WTP estimate is biased.

Prospect theory (Kahneman and Tversky, 1979) provides insight into how people process information and is helpful in understanding how experiment participants evaluated information on price and discount. Prospect theory defines a decision process with an editing stage, where information available to the decision maker is framed to simplify the computation or decision. Several empirical studies have shown that old or common information is often ignored in this stage, which would apply to existing market prices that were reported to participants before they selected a discount coupon. Kahneman and Tversky (1979) also cite studies showing that cognitive factors can affect framing, which in this study could have led participants to focus on discounts instead of making a mental calculation of net prices. Another prediction of prospect theory is that people emphasize what can be gained in the present. In this experiment, participants were receiving a coupon to purchase chicken, so the discount might have been emphasized.

If experiment participants do treat price and discount differently, the appropriate utility representation would be $U_i = \boldsymbol{\beta} z(c_i) + \delta_1 d_i + \delta_2 p_i$ (Specification 2), as opposed to $U_i = \boldsymbol{\beta} z(c_i) + \delta(p_i - d_i)$ (Specification 1). Specification 1 would be

consistent with fully rational behavior. We can use likelihood ratio tests to see which specification best fits our data. However, we will not be able to empirically distinguish between behaviors predicted by prospect theory and low variation of prices, as the prices of chicken that were reported to experiment participants had low variation within the same neighborhood. Both cases would lead to underestimation of consumer valuation of SLC, as δ_2 would be lower than in reality or statistically insignificant. In either case, results could be interpreted in the context of lower observed price coefficients.

Our measure of the value of SLC is a measure of willingness to receive a lower discount for certification (in the case that the coupon was redeemed). The discount coupon selected in this experiment was not hypothetical, but there was an option to redeem or not redeem, which raises concerns of potential upward bias of WTP for safety labels. A major problem with stated preference exercises is that desirable characteristics are overvalued, given that participants do not have to make any commitment of their own money or resources. Although SLC and local chicken are desirable characteristics, a higher discount coupon is also desirable and could be gained instantly by participants. In this experiment, a higher discount could have been emphasized by participants who were uncertain of redemption, which would bias WTP estimates downward. Furthermore, hypothetical choice experiments have been shown to have a much lower bias than most stated preference exercises and no bias for marginal WTP measurements (Lusk and Schroeder, 2004). The design of the experiment, hence, addresses many challenges of implementing a field experiment in a situation with price negotiation and informality, while having real coupons mitigates the upward bias of valuation associated with hypothetical experiments.

3. Summary statistics

The majority of survey respondents was relatively affluent and well-informed women. Ninety-two percent of respondents were women, and 63% were employed at least part time. Sixty-four percent of all households surveyed had at least one member with a university education. Average annual per capita food expenditure was roughly equivalent to the per capita gross national income of $890 in 2008 (World Bank, 2011), indicating that respondents were in the middle- to high-income brackets in Vietnam. Sixty-seven percent of respondents had received information on HPAI within the past six months, and less than 5% of the sample answered basic questions about safe poultry handling incorrectly.

Slightly over half of all respondents had crossbred chicken as the variety of their regular (no safety label) chicken alternative. Although the variety was randomly assigned, there was some variation based on availability of breeds at specific project vendors. Average prices and standard deviation of prices of the three types of chicken offered can be found in Table 1. Local chicken is the most expensive while crossbred was the cheapest.

Table 1

Average chicken prices for project vendors, per kg

	Mean	Std. deviation
Safety-labeled chicken (crossbred)	U.S.$ 5.13	U.S.$ 0.72
Regular crossbred chicken	U.S.$ 4.59	U.S.$ 0.53
Regular local chicken	U.S.$ 6.14	U.S.$ 0.21

Table 2

Percent of households selecting safety-labeled chicken by breed of unlabeled alternative

Difference in discount	Crossbred alternative		Local alternative	
	Percent	Obs.	Percent	Obs.
$<-2{,}500$ VND	57%	112	28%	98
$-2{,}500$ VND	70%	77	39%	66
Same discount	91%	89	65%	83
2,500 VND	94%	84	71%	62
$>2{,}500$ VND	96%	129	85%	87
Total	82%	491	57%	396

Note: Discount for safety-labeled chicken less the discount for unlabeled chicken.

Crossbred and SLC had the most variation in price. The average discount was $U.S. 1.25.

The choices that survey respondents made based on level of discount are summarized in Table 2. In Table 2, we can see that, when the same discount was offered for each alternative, participants selected SLC 91% of the time when the alternative was crossbred and 65% of the time when the alternative was local chicken. Likewise, when the discount for SLC was 2,500 Vietnamese Dong (VND) larger than the alternative, 96% of participants selected SLC when the alternative was crossbred, whereas 85% of participants selected SLC when the alternative was local. The 2,500 VND is about $U.S. 0.17.

Experiment participants responded to increasing levels of discount and, when there was no "taste trade-off," between local and crossbred chicken, SLC was almost always selected. However, participants were less likely to select SLC if local chicken was an alternative. These findings can be interpreted in context of current chicken consumption of households (Table 3). Seventy-five percent of households are regularly choosing to consume local chicken over crossbred or other options. The presence of a brand and safety claims led some participants in our study to select crossbred instead of local chicken, including participants that are used to purchasing live local chicken from informal sources. Forty percent of all local chicken is purchased live while, for crossbred and industrial chicken, a higher level of processing is more common.[5] These habits confirmed our choice of experimental design, especially to have SLC that was being sold in traditional markets, as opposed to a more formal outlet.

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[5] Selling of live chicken in Hanoi has been illegal since initial HPAI outbreaks but is still common.

Table 3
Previous chicken consumption characteristics

Breed	N	Price	Purchased live	Purchased in cuts	Purchased from informal sources	Stamped or Govt. inspected	Supplied by a company
Local	1,220	$5.21	41%	8%	88%	22%	5%
Crossbred	195	$4.51	17%	43%	64%	19%	36%
Industrial	201	$3.57	3%	87%	81%	36%	27%

Note: Survey participants reported up to three occasions of previous chicken consumption, so the number of observations is greater than the number of survey participants.

Table 4
Logit model estimation results

	Specification 1	Specification 2
Discount		3.471***
		(0.678)
Price		0.052
		(.215)
Price less discount	−0.350	
	(0.260)	
Safety label	1.719***	1.722***
	(0.279)	(0.318)
Local breed (taste)	1.378***	1.258***
	(0.368)	(0.408)
Obs.	1,774	1,774
Log-likelihood	−499.918	−428.204

Note: Three asterisks (***) indicate statistical significance at $P = 0.01$. Standard errors are robust to correlation at the block level.

4. Results

Results from estimation of our logit model with Specifications 1 and 2 for price and discount can be found in Table 4. A safety label appears to have a consistent effect across both specifications as does local breed. We observe that all coefficients other than price in Specification 1 have a statistically significant effect at the 1% test level. The price coefficients across both specifications are small relative to other explanatory variables. We use the results from Specifications 1 and 2 to test the null hypothesis that $\delta_1 = \delta_2$ or that discount is given the same weight as price by experiment participants. We use a χ^2 test and compare the ratio of log-likelihoods of each specification based on Train (2003) and strongly reject that $\delta_1 = \delta_2$. Given this difference, it is not appropriate to treat discount and price effects as the same and Specification 2 better fits our data. This result is consistent with implications of prospect theory previously discussed or participants emphasizing the discount during the decision process.

Given differential valuation of prices and discount and statistically insignificant price effects, incorporating prices coefficients into calculation of WTP would lead to biased estimates. Alternatively, the WTP for SLC calculated with the discount coefficient (δ_1) can only be considered a lower bound. Holding breed constant, the upper bound can be calculated as the lower bound WTP in addition to the existing price differential between safety-labeled crossbred chicken and reg-

Table 5
Valuation of chicken characteristics

	WTP Lower bound	WTP Upper bound	SE
Safety label	0.50***	1.04	0.174
Local breed	0.36**	1.90	0.181

Note: Three asterisks (***) indicate statistical significance at $P = 0.01$. Two asterisks (**) indicate statistical significance at $P = 0.05$. Standard errors are calculated using a cluster (block) bootstrap with 3,000 iterations and are robust to correlation at the block level.

ular crossbred chicken. The upper bound assumes that participants "rationally" treat the discount the same as price, as predicted by utility theory. The WTP in this case would be C s.t. $U(s = 0, p|\text{variety=crossbred}) = U(s = 0, p - C|\text{variety=crossbred}) \rightarrow C = \frac{\beta_1 - \delta_2(p_i - p_k)}{\delta_1}$. If $\delta_1 = -\delta_2$, then $C = \frac{\beta_1}{\delta_1} + (p_i - p_k)$. This is our upper bound estimate, which assumes that prices would never have a greater contribution to utility than discount, or $\delta_1 \geq -\delta_2$. We must also assume that the price of SLC is at least as high as the price of regular chicken, which is consistent with our data. Actual WTP would likely be between these two estimates as we expect prices to have some impact on utility but at a lower weight than discount. The same argument applies to the upper and lower bounds to WTP for local chicken or for taste.

Results for valuation of a safety label can be found in Table 5 and are calculated from the results reported in column 1 of Table 4. As indicated in column 1 of Table 5, the lower bound WTP calculated from the safety label is $0.50 and is statistically significant at the 1% test level.[6] The lower bound WTP for a local breed is $0.36 and is statistically significant at the 5% test level. Average prices for crossbred chicken, project chicken, and local chicken at the time of the study as reported to survey respondents were $4.59, $5.13, and $6.14, respectively. Given a market price differential of $0.54, the upper bound valuation of safety labeling is $1.04 per chicken purchase. Our reported upper bound should be considered an average upper bound, as it uses average prices across all markets. It takes values of $0.91, $0.97, $1.05, and $1.46 if estimated using the price differential in the four markets projects. Likewise, the (average) upper bound valuation for local chicken would be $1.90.

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[6] All standard errors for WTP in this article are calculated using a cluster bootstrap with 3,000 iterations.

Table 6
Marginal effects (ME) and elasticity for selecting safety-labeled chicken

		SE
ME: Discount	0.63***	0.144
ME: Local breed (taste)	0.23***	0.083
Elasticity: Discount	1.03***	0.272

Note: Three asterisks (***) indicate statistical significance at $P = 0.01$. Standard errors are calculated using a cluster (block) bootstrap with 3,000 iterations and are robust to correlation at the block level.

Table 7
Logit model estimation results: tests for behavioral biases

	Taste (1)	Safety (2)	Linearity (3)
Discount	−3.453***	−3.511***	−2.300
	(0.693)	(0.686)	(3.498)
Price	0.052	0.052	0.054
	(0.213)	(0.214)	(0.215)
Safety label	1.720***	1.820*	1.720***
	(0.320)	(0.959)	(0.318)
Local breed	1.172	1.258***	1.256***
	(1.048)	(0.410)	(0.406)
Local discount interaction	−0.066		
	(0.741)		
Safety discount interaction		0.078	
		(0.648)	
Discount squared			0.468
			(1.286)
Obs.	1,774	1,774	1,774
Log-likelihood	−428.198	−428.193	−428.155

Note: Three asterisks (***) indicate statistical significance at $P = 0.01$. One asterisk (*) indicates statistical significance at $P = 0.1$. Standard errors are robust to correlation at the block level.

Marginal effects measure the change in probability that an alternative will be selected given the characteristic is present and are reported in column 2 of Table 6. A chicken with an increase in discount of $1.00 had a 0.63 higher probability of being selected, and a chicken that was a local breed had a 0.23 higher probability of being selected. The discount elasticity reported in column 3 is analogous to price elasticity of demand: a discount elasticity of 1.03 for SLC indicates that a 1% increase in discount for SLC is associated with a 1.03% increase in the selection of SLC.

In Table 7, we present results from the estimation of three specifications that give insight into potential biases of participants. We first interact the characteristic and discount variables to test for different weighting of discounts for local and SLC . The coefficients on each interaction variable found in columns 1–2 of Table 7 are of small magnitude and not statistically significant, which indicates that discounts were not weighted differently for safety or taste (local breed) characteristics. The variable "discount squared" used in regression 3 is not statistically significant and, hence, we find no evidence that utility weights given to discount are nonlinear.

A total of 65 participants redeemed the coupon that they had selected. This number was lower than expected although not inconsistent with other studies, such as Loureiro et al. (2003). There are several plausible explanations for this that were difficult to anticipate or address at the time of implementation. Very few participants reported consuming chicken more than once per week, so the one week "expiration" of the coupon might have been too short. If there was no plan to consume chicken within a few days, the coupon might not have been redeemed. However, given the length of the pilot project, this was the only way to have a uniform expiration period.

Each market usually has several poultry vendors, and only two to three in each market were involved in the project. Of all chicken purchases reported by project participants, 96% were from a vendor or location that they regularly use. Negotiating with an unfamiliar vendor might have added a transaction cost that decreased the likelihood of redeeming the discount coupon. Furthermore, the price of live local chicken was $4.80 per kg, which was cheaper than the average prices for slaughtered chicken for which the coupons could be redeemed. Given preferences for local breeds, the discount, again, might not have been large enough to overcome the transaction cost of buying from a new vendor. If this experiment design is replicated, many of these issues could be addressed and more attention could be given to the likelihood of coupon redemption. In this experiment, extensive testing was limited by the short timing of the FAO project.

The relatively low coupon redemption rate might raise some concerns for the feasibility of a larger scale labeling scheme. A major challenge for coupon redemption was the transaction cost of buying chicken from an unfamiliar source. This should not limit actual market development. The project worked with a relatively small number of vendors out of necessity. Individual vendors in the same market tend to source from the same slaughterhouses, which would be an important part of market development and would allow for a larger distribution. Supermarkets could also use certification schemes like this one to become more competitive for fresh chickens sales. Furthermore, although live chicken sales are an important policy concern, the majority of chicken is purchased slaughtered and this would be a large market for any labeling scheme.

As previously stated, this approach to a field experiment not only introduces actual money in the form of a coupon and uses the product of interest, but likely reverses the direction of any potential bias from the coupon being optional as opposed to mandatory. This idea is borne out in the data. When logit estimation is restricted to participants that redeemed a coupon, the lower bound WTP for a safety label is $0.81, and is statistically significant at the 5% test level. This result supports the proposition that participants that were less certain of coupon redemption would have focused on receiving a higher discount, which leads to lower estimated valuation of safety. This result also supports the robustness of our main result as a lower bound WTP for safety labeling.

Table 8

Logit model estimation results: impact of household and consumption characteristics

Description of variable	Mean	Coefficient (SE[+])
Concern for chicken flavor (scale of 1–10)	7.2	−0.009 (0.065)
Concern for chicken origin (scale of 1–10)	7.4	−0.120 (0.105)
Concern for avian flu (scale of 1–10)	8.3	0.060 (0.078)
Previous purchase of private-branded chicken	0.58	−0.076 (0.366)
Weekly chicken consumption (kg)	0.83	−0.175 (0.132)
Age of survey participant	47	−0.005 (0.008)
Participant is employed	0.63	−0.085 (0.208)
Participant recently exposed to HPAI information	0.67	0.125 (0.314)
Participant incorrectly answered basic HPAI questions	0.23	−0.179 (0.261)
Participant had previously heard of project chicken	0.07	−0.115 (0.345)
Participant regularly shops at project chicken market	0.55	0.233 (0.299)
Concern for brand purchases (scale of 1–10, summed for five products)	29.57	−0.044 (0.017)***
Education level of household adults (1–5: 1 = primary, 5 = university)	3.3	0.310 (0.220)
Enumerator appraisal of wealth level (scale of 1–5)	2.8	0.028 (0.145)
Trust in market inspector (scale of 1–10)	5.28	−0.194 (0.058)***
Number of children under 10	0.60	0.187 (0.134)
Percent of household members under 23 years old	0.33	−1.001 (0.573)*
No change in food purchases due to inflation	0.61	−0.122 (0.260)
Number of supermarket trips per month	0.89	0.001 (0.076)
Percent of food expenditure spent for eating outside of the home	0.28	−2.718 (1.164)**
Meat consumption per capita ($U.S.)	7.22	0.048 (0.057)
Weekly per-capita food expenditure ($U.S.)	17.60	0.010 (0.026)
Percent chicken purchased: local breed	0.77	−0.407 (0.296)
Percent chicken purchased: live	0.35	−0.050 (0.270)
Percent chicken purchased: processed	0.20	0.645 (0.295)**
Percent chicken purchased: government certified	0.25	0.699 (0.303)**
Percent chicken purchased: sold by a company	0.11	0.070 (0.375)

Note: Each variable was interacted with the safety label indicator and individually added to and estimated using the logit model (Specification 2), and the coefficient reported is the coefficient of the interaction variable. Three asterisks (***) indicate statistical significance at $P = 0.01$. Two asterisks (**) indicate statistical significance at $P = 0.05$. One asterisk (*) indicates statistical significance at $P = 0.1$. [+]Standard errors (SE) are robust to correlation at the block level.

4.1. Impact of household characteristics

Various household characteristics were each individually estimated with our logit model, with results summarized in Table 8. The left column describes each variable, the middle

Table 9

Logit model estimation results with heterogeneity

	Multiple characteristics	Limited characteristics
Discount	3.658***	3.586***
	(0.745)	(0.334)
Safety label	2.394***	2.111***
	(0.872)	(0.585)
Local breed (taste)	1.311***	1.298***
	(0.406)	(0.199)
Price	0.134	0.117
	(0.220)	(0.118)
Chicken consumption, kg	−0.161	
	(0.124)	
Preference for brands	−0.032*	−0.042***
	(0.017)	(0.013)
Household education level	0.479*	0.465***
	(0.256)	(0.156)
Trust in market inspector	−0.140**	−0.143***
	(0.066)	(0.045)
Number of children under 10	0.172	
	(0.126)	
Percent expenditure spent eating out	−1.539	
	(1.049)	
Percent local (breed) chicken purchases	−0.252	
	(0.332)	
Percent processed chicken purchases	0.122	
	(0.356)	
Percent Govt. certified chicken purchases	0.488**	0.555**
	(0.237)	(0.245)
Obs.	1,692	1,706
Log-likelihood	−384.069	−388.801

Note: Three asterisks (***) indicate statistical significance at $P = 0.01$. Two asterisks (**) indicate statistical significance at $P = 0.05$. One asterisk (*) indicates statistical significance at $P = 0.1$. Standard errors are robust to correlation at the block level.

column is the mean of each variable, and the right column gives the coefficient (β_3) and its standard error from the logit estimation. Each coefficient can be interpreted as the relative share of utility from consuming SLC corresponding to the level or presence of a characteristic. The magnitude of the coefficients on household characteristics is small relative to those of chicken characteristics reported in Table 4. Based on the results reported in Table 8, it appears that several households' characteristics have a significant impact on demand for safety.

In Table 9, we add multiple characteristics and consumption habits to our model based on the results from Table 8 with the objective of improving goodness of fit while maintaining parsimony. Some of the characteristics that were individually statistically significant no longer impacted demand for safety when estimated with other characteristics. This is demonstrated in the column of Table 9 labeled "Multiple Characteristics." Specifically, the impact of chicken consumption, number of children under 10, expenditure eating outside of the home, local chicken purchases, and processed chicken purchases have effects that are not statistically significant when other characteristics are controlled for. Several different combinations of characteristics were added to the model and estimated before determining that

the model that was estimated with "limited characteristics," as indicated in Table 9. This model is limited to characteristics that have a significant and robust impact on demand for safety labeling. Education, brand certification, trust of market inspectors, and purchase of government certified chicken appear to have the largest (and most stable) influence on demand for SLC, and the inclusion of additional variables would not significantly improve the fit of our model.

Concern for HPAI has a small positive impact whereas concern for the source of chicken has a negative sign, but these variables are not statistically significant. This might indicate that valuation of SLC is related to more general safety concerns or that these subjective safety rankings do not related to actual preferences. Furthermore, purchasing higher levels of live chicken, local chicken, processed chicken, and chicken supplied by a company have no statistically significant impact on preferences for SLC once other characteristics are controlled for. Overall, these results indicate that not all consumption habits and stated attitudes related to chicken consumption are important in determining preferences for SLC.

Respondents with a higher level of trust in their local (government) market inspector were less likely to prefer SLC, which implies that low trust in local institutions increases demand for guarantees of safer chicken. Respondents were asked for their level of trust in varies entities, such as companies, the Department of Animal Health, and their local market vendors. Local market inspectors had the lowest score. However, consumers that purchased government inspected chicken had a higher valuation of safety labeling. Given that we were controlling for trust in government inspection, purchasing inspected chicken likely implies a preference to shop at the more hygienic markets where most chickens are inspected. Private or external safety certification of chicken seems to be an attractive option or substitute for consumers who exhibit attitudes and behavior that indicate a demand for certification.

The result that education increases valuation of healthy chicken is consistent with information and wealth playing a role in food consumption decisions. Educated individuals might have more knowledge of risks or more interest in purchasing safer food, as well as significantly higher incomes. Education is strongly correlated with income in Vietnam. The relative roles of income and education in forming attitudes toward food safety is an interesting area for future research. Jin and Mu (2012) find that in China income has a positive and significant impact on WTP for poultry traceability, but education has no significant impact.

Concern (or preference) for brand purchases was asked for five categories: cosmetics, appliances, liquor, clothes, and vegetables. The variable used in our estimation is an aggregation of those rankings. Concern for brand purchases has a negative and significant coefficient, but the coefficient is of very low magnitude. This finding mitigates concerns that demand for safety labeling is driven by demand for branded foods. If the safety label was perceived as a brand, this coefficient should have been positive.

Table 10
WTP with heterogeneity

	WTP (Lower bound)	WTP (Upper bound)	SE
Local breed (taste)	$0.36**	$1.90	0.177
Safety label	$0.54***	$1.08	0.208

Note: Three asterisks (***) indicate statistical significance at $P = 0.01$. Two asterisks (**) indicate statistical significance at $P = 0.05$. Standard errors are calculated using a cluster (block) bootstrap with 3,000 iterations and are robust to correlation at the block level.

Table 11
Logit model estimation with heterogeneity: marginal effects

	Marginal effects	SE
Discount	0.616***	0.153
Local breed	0.229***	0.083
Trust in market inspector	−0.025**	0.011
Education	0.080*	0.041
Brand preference	−0.007**	0.003
Percent Govt. certified purchases	0.095**	0.042
Obs.	1,706	
Log-likelihood	−388.801	

Note: Three asterisks (***) indicate statistical significance at $P = 0.01$. Two asterisks (**) indicate statistical significance at $P = 0.05$. One asterisk (*) indicates statistical significance at $P = 0.1$. Standard errors are calculated using a cluster (block) bootstrap with 3,000 iterations and are robust to correlation at the block level.

The WTP for safety labeling that takes into account household characteristics has a lower bound of $0.54 and an upper bound of $1.08, which is very similar to the WTP in the model without household characteristics. Table 10 shows the standard errors of WTP for safety using the model estimated with limited characteristics found in Table 9. Table 11 shows the marginal impact of an increase of one unit of each characteristic on the likelihood of a participant selecting SLC in the experiment. Increases to education and purchases of government certified chicken have the largest impact on selecting safe chicken, while trust in market inspectors and brand preferences have a much smaller impact.

4.2. Policy implications

These results have implications for the feasibility of safety labeling of free-range chicken in Vietnam. We first consider the potential costs of a labeling scheme. Using nationally representative data as detailed in the Appendix, we calculate the per-unit (bird) increase in costs. The increase in production costs of $0.08 could be covered by the WTP of $0.50, and additional certification costs, such a tag (about $0.10 or less) or a 10% monitoring fee of $0.02, are also reasonable. The additional production-related costs of certification should not be a barrier to safety labeling.

These results can also provide an estimate of WTP to reduce perceived risk. Although deaths have occurred from contact

with live HPAI-infected chickens and no known deaths have occurred from eating HPAI-infected birds, HPAI is still a serious concern for consumers, who often handle raw meat or live birds. Our survey indicated that HPAI is the largest safety concern of consumers but that other safety-related concerns are also significant. Hence, we assume that half of the WTP for SLC is for its non-HPAI related attributes. We use a range of perceived probabilities of death from purchasing HPAI-infected chicken to estimate the implied statistical value of life from the WTP for SLC. The maximum perceived probability of death from purchasing HPAI-infected chicken can be based on the number of deaths from HPAI (which are widely reported in the media) relative to the total number of chickens consumed. Given annual household consumption of about 30 chickens per year for an estimated 15 million households in Vietnam, and an average of 10 deaths per year (from 2003 to 2007), the maximum implied statistical value of life based on our WTP estimate is $11.25 million.[7] The implied statistical value of life could be considered high relative to the gross domestic product of $3100 of Vietnam, although income for our urban sample is significantly higher than the average. However, our estimate is more modest when compared to other estimates based on consumer demand for safety or government spending. For example, the statistical value of life in the United States based on pesticide regulation is $35 million (Cropper et al., 1992).

Most likely, consumers do not assume such a low probability of death from HPAI, as people often overestimate the risk of catastrophic events (Camerer and Kunreuther, 1989). If perceived HPAI risk is higher, then implied statistical value of life is lower. If consumers were to assume a one of one million probability of dying from HPAI, the implied statistical value of life is $500,000. This estimate is more in line with income in Vietnam, but still assumes an extremely low probability of death from HPAI. If the assumed probability is one of 100,000, the implied value of life is $50,000. Future studies on demand for certified foods in developing countries could provide useful comparisons if implied statistical value of life is calculated, especially if surveys collect information on perceived risk.

We also consider the possibility that experiment participants might perceive the label to be a sign of improved quality, as opposed to or in addition to improved safety. Although this perception would not necessarily hurt a larger scale labeling scheme and might potentially help such a scheme, it will affect the interpretation of our results. As previously discussed, the key quality factor for chicken is breed. Hence, if participants interpreted the label as a sign of quality, those participants who regularly purchase high-quality breeds should have a higher willingness for the safety label. However, we find that previous purchase of local (high quality) chicken has no statistically significant impact on the valuation of the safety label. We also find that preference for branded products does not increase valuation of SLC. This provides strong evidence that consumer

valuation of safety labels is not confounded by taste or quality preferences.

5. Conclusion

This article presents a novel methodology for a field experiment using coupons. We find a significant WTP for safety-labeled free-range chicken in Hanoi, approximately a 10–15% premium. Through developing a new variety of chicken that was both free-range and safety-labeled, we implemented a field experiment that addresses many of the challenges of valuing food characteristics in developing country settings. We found evidence that more educated consumers are interested in SLC, which supports the proposition that demand for safer chicken will increase as incomes and education grow in Vietnam. The previous choice of chicken breed also did not affect selection of SLC, which was always crossbred. This result indicates that safety branding could be effective for different types of free-range chicken, and hence reach a broader market.

These results show that one potential way to address HPAI and other food safety and environmental issues is through market-based incentives for farmers to adopt new practices. This approach might be considered as a viable means for payment for health and environmental services. Developing a market for safety-labeled free-range chicken might be challenging from a supply side perspective, but consumer demand will not be a barrier to market-based approaches to improve the safety of poultry production and handling practices for free-range chicken. Future research presents two major challenges, including designing supply chains that deliver "health services" in developing countries, and measurement of WTP for health and environmental services in a realistic setting. The research and development agenda to develop market based solutions to environmental and public health problems is ongoing and should be expanded. The approach used here could be used in both developed and developing country settings to show where such market-based solutions might be appropriate.

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[7] Based on consumption in our survey of Hanoi consumers

Appendix

A.1. Estimating the costs of certification

The costs from the pilot project are not be considered representative, as the project was for demonstration purposes and involved up-front costs that would not be incurred in a longer term labeling program. Instead, we can consider the changes in unit costs of production when a farmer increases the scale of chicken production. Most of the on-farm costs associated with labeling of free-range chicken would involve ensuring that chickens are enclosed in a grazing area as well as increasing inputs, such as vaccination. These are typical changes that are also associated with increasing the scale of production.

An advantage of this approach is that we can use costs that are based on a national household survey. Analysis of the Vietnam Household Living Standards Survey, 2002, by Agrifood Consulting International (2007) provides representative costs for increasing the scale of production. Specifically, we consider the cost of moving from Sector 3 (51–200 kg production/year) to Sector 2 (201–2,000 kg production/year). The unit cost for Sector 3 is approximately $0.68 per unit whereas the unit cost for Sector 2 is $0.76 per unit, so the total per unit increase in certification costs would be $0.08.

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